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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/071,356	02/08/2002	Rene Helbing	10010648-1	2798

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AGILENT TECHNOLOGIES, INC.  
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EXAMINER

BOUTSIKARIS, LEONIDAS

ART UNIT PAPER NUMBER

2872

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Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/071,356	<b>Applicant(s)</b> HELBING, RENE	
	<b>Examiner</b> Leo Boutsikaris	<b>Art Unit</b> 2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 14 March 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 2-20, 22-28 and 30-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2, 9-12, 15, 16, 22, 23, 26, 28 and 30 is/are rejected.
- 7) ☒ Claim(s) 3-8, 13, 14, 17-20, 24, 25, 27 and 31-33 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 February 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 2, 9-12, 15-16, 22-23, 28, 30 are rejected under 35 U.S.C. 102(b) as being anticipated by Pan (US 6,181,846).

Regarding claims 2, 30, Pan discloses an optical device (Fig. 1) comprising:

a polarization-controlling reflector (18, 19), said reflector converting incident-light polarization components (see pair of light components traveling towards the reflector in element 16 in Figs. 3B-3C) having incident angles of polarization into reflected-light polarization components (see pair of light components traveling from the reflector in element 16 in Figs. 3B-3C) having reflected angles of polarization, the reflector having two states, and being controllable such that the reflector can be changed from one state to another (see, for example Fig. 3B representing state ON and Fig. 3B representing state OFF), said reflected angles of polarization having an orientation relative to the incident angles of polarization, the orientation being a function of the state of the reflector (for example, the former having a 90 degrees rotation relative to the latter when the reflector is the ON state); and

a polarization-dependent optical-path device, in the form of birefringent element 15, said device converting input-light polarization components that are at least partially spatially-coincident (see light components emerging from optical fiber 10) and that have been coupled into the optical device into spatially-separated input-light polarization components (see solid and dotted line paths, said polarization-dependent optical-path device 15 converting said spatially-separated input-light polarization components into said spatially-separated incident-light polarization components (notice that the polarization components at the output of 15 travel through lens 16 without any change in their polarization state before being incident onto the reflector), and wherein when said reflector is in a first one of the two states (ON state), said orientation is such that said polarization-dependent optical-path device 15 causes at least a portion (substantially all in Fig. 3B) of the reflected-light polarization components to be out-coupled from the optical device,

wherein said polarization-dependent optical-path device includes an input polarization-dependent path splitting element (i.e., the same birefringent element 12), said element converting said input-light polarization components that are at least partially spatially-coincident (light emerging from the fiber 10) into said spatially-separated input-light polarization components, thereby defining a branched input (see how a single input at the output face of optical fiber 10 is converted to two separate rays, each having a different polarization), see line 46, col. 2 to line 49, col. 3, lines 48-50, col. 8).

Regarding claim 9, the input-light polarization components coupled into the optical device and the reflected-light polarization components out-coupled from the device at least

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partially share a common optical path with the device (see, for example, arrowed lines to and from reflector 18 within the device (15, 16).

Regarding claim 10, the input-light polarization components coupled into the optical device propagate along an optical path that is distinct from the optical path the reflected-light polarization components that are out-coupled propagate (see, for example, the input light traveling in the upper half of the device and the out-coupled light traveling in the bottom half of the device in Fig. 3B).

Regarding claims 11-12, 15-16, in one embodiment (Fig. 7, lines 40-58, col. 6), Pan discloses an optical switch having two inputs, i.e., 50 and 52, and two outputs, i.e., 51, and 53, respectively. Light that is incident from input 50 or 52 is reflected from the reflector (68, 69) and is directed to respective output 51 or 53. For each input signal, the operation is the same as described above.

Regarding claim 22, the integrated device of Fig. 3 comprises at least a first input port (receiving optical fiber 10), at least a first output port (leading into optical fiber 11); a substantially non-reciprocal directional stage comprising birefringent element 15 (light cannot trace back to its input point) receiving input light and operating on the polarization components of the received light; a reflective element (18, 19) as described above; and a polarization stage 16 interposed between the directional stage 15 and the reflective element (18, 19), the polarization stage (i.e., lens 16) directing the polarization components of light propagating through the directional stage 15 onto the reflective element 18 by operating on the polarization components received by the polarization stage 16 from the directional stage 15, and wherein the polarization stage 16 directs light components reflected from the reflective element into the directional stage

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with a polarization that depends on the state of the reflective element (lines 11-21, col. 3) to enable the directional stage to control the path of propagation of the reflected light based on the polarization of the reflected light components (i.e., see Fig. 3B compared to Fig. 3C).

Regarding claim 23, when the reflector is in the ON state, substantially all the light is out-coupled from the device through the first output port and substantially none of the reflected light is output from the device through the first port (see Fig. 3B).

Regarding claim 28, the reflective element is a liquid crystal cell (line 65, col. 2).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pan (US 6,181,846) in view of Chang (US 6,360,034).

Pan discloses all the limitations of the above claim, including the limitation that the directional stage comprises birefringent walk-off crystal 15. However, Pan does not disclose the use of a Faraday rotator for manipulating the polarization of the light components along with the walk-off crystal. Chang discloses a reflective optical switch, comprising a walk-off crystal 380 and Faraday rotators 370 and 360 for manipulating the polarization of the light components as they are traveling towards and from mirror 340 (Fig. 3, line 66, col. 7 to line 50, col. 8). It would have been obvious to one of ordinary skill in the art at the time the invention was made to

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include a Faraday rotator in the optical switch of Pan, after the walk-off crystal 15, for achieving additional control on the polarization state of the light components traveling inside the device.

***Allowable Subject Matter***

Claims 3-8, 13-14, 17-20, 24-25, 27, 31-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 3-8, 13-14, 17-20, 24-25, 27, 31-33 are allowable over the prior art of record for at least the reason that even though the prior art discloses reflective optical switches wherein a liquid crystal element is used to switch the polarization of the incident light components, the prior art fails to disclose or reasonably suggest, regarding claims 3-8, an optical device comprising an output-polarization-dependent path splitting element converting the spatially-separated reflected light components having reflected angles of polarization into spatially-separated reflected-light components having output angles of polarization, thereby defining a branched output, regarding claims 13-14, an optical device, wherein when the reflector is in a second one of the plurality of states, the polarization-dependent optical-path device causes at least a portion of the first and a portion of the second set of reflected-light polarization components to be out-coupled from the optical device through the second and the first output port, respectively, regarding claims 17-20, an optical device, wherein the polarization-dependent optical-path device includes an output-polarization-dependent path splitting element converting the first set of spatially-separated incident-light components and the second set of spatially-separated incident-light components into a first and a second set of spatially separated reflected-

light components having reflected angles of polarization that are different from the incident angles of polarization of the first and the second set of spatially-separated incident-light components, respectively, regarding claims 24-25, an integrated optical device, wherein when the reflective element is in a second one of the plurality of states, at least a fraction of the reflected light is out-coupled through the second output port, regarding claim 27, an integrated optical device, wherein the polarization stage comprises at least one birefringent element, and regarding claims 31-33, a method for operating on light, wherein the polarization-dependent optical-path device includes an output-polarization-dependent path splitting element converting the spatially-separated reflected light components having reflected angles of polarization into spatially-separated reflected-light polarization components having reflected angles of polarization, thereby defining a branched output, as set forth by the claimed combination.

Xiao (US 6,795,245, Fig. 5), Hoyt (US 6,781,736, Fig. 1) and Li (US 6,944,363, Fig. 1) all disclose reflective optical switches incorporating a series of walk-off crystals, controllable optical rotators, such as Faraday rotators, and a mirror. However, in the above systems, the optical mirror is disposed away from the controllable optical rotator, with other optical elements, such as retarders, and prisms disposed between the mirror and the controllable optical rotator.

### ***Response to Arguments***

Applicant's arguments with respect to claims 2-20, 22-28, 30-33 have been considered but are moot in view of the new ground(s) of rejection.

Regarding claim 2, and Applicant's assertion that Pan does not disclose an input polarization-dependent path splitting element that defines a branched input, the examiner respectfully disagrees and notes that, as described above, the birefringent crystal 15 receives an input light signal having two orthogonal polarizations and splits it into two spatially separated rays having orthogonal polarizations, thus defining a branched input. Applicant's argument that Pan's device is such that light can travel only from one input to one output, as opposed to the claimed invention, is irrelevant to the plain interpretation of the claim language "an input polarization-dependent path splitting element that defines a branched input".

Regarding claim 22, and Applicant's argument that the GRIN lens 16 in Pan's device is not the "polarization stage" recited in claim 22, the examiner respectfully disagrees and notes that nothing in the claim language referring to the "polarization stage" constitutes a positive limitation which is related to the polarization properties of the "polarization stage" itself. Specifically, it is submitted that element 16 in Pan's device "directs the polarization components of light propagating through the directional stage onto the reflective element by operating (for example, focusing) on the polarization components of the light received by the polarization stage from the directional stage", and furthermore it "directs light components reflected from the reflective element into the directional stage with polarization that depends on the state of the reflective element", so that "the directional stage control[s] the path of propagation of the reflected light based on the polarization of the reflected light components."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Leo Boutsikaris whose telephone number is 571-272-2308.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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December 5, 2005



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